A NEUTRON-BEAM FACILITY

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Some general aspects of the design and experimental use of neutron beams at the 200 GeV accelerator have been previously discussed. ^{1,2} The purpose of this note is to describe a specific neutron beam suitable for installation at the heavy target stations B and/or C. ³ It is hoped that this will serve as direct input for the detailed design of experiments, or as a point of departure for considering more useful neutron beams.

A list of beam components is given in Table I and Figure 1 shows the layout. Essentially the beam consists of a line-of-sight hole through the hadron and muon shielding at an angle of 2.0 mrad. from the incident proton beam. The length is 360 ft. and subtends a solid angle of 10^{-8} sr. for a beam diameter of about 1/2 inch at the experiment site. Collimators and sweeping magnets are placed so as to be easily compatible with our present vision of the charged particle beams and shielding associated with these target stations.

The neutron spectrum is approximated by the use of the Trilling formula for protons ⁴ and is shown in Figure 2. This method yields an integrated flux of ~10⁹ neutrons per 10¹³ interacting protons in the primary beam.

Specifications for the beam are collected in Table II.

The γ component is the only beam contaminant which is likely to exceed a few per cent of the neutron flux. Read ¹ has used the Trilling formula to predict π^0 production and thence to obtain the γ spectrum. By this method,

a 15% contamination of γ 's whose average energy is about 30 GeV is indicated for the present neutron beam. Lead converters can of course be placed in front of the sweeping magnets to reduce the γ flux, though their optimum design is non-trivial in view of the extensive showers which are produced.

References

- A. L. Read, 200 BeV Accelerator: Studies on Experimental Use, Vol. 1, p. 256, April, 1966.
- 2. Michael J. Longo, NAL Internal Physics Note FN-142.
- 3. National Accelerator Laboratory Design Report p. 14-1, Jan. 1968.
- 4. G. H. Trilling, 200 BeV Accelerator: Studies on Experimental Use, Vol. 1, p. 25, April, 1966.

Table I: Beam Components

	Component	Length, ft.	Distance from end of target to end of component, ft.	Collimator diameter, in.
1.	Drift Space	32	32	-
2.	Collimator	64	96	, 134
3,	Sweeping Magnet	32	128	-
4.	Collimator	16	144	. 200
5.	Sweeping Magnet	16	160	-
6.	Collimator	16	176	. 245
7.	Drift Space	136	312	-
8.	Sweeping Magnet	16	328	-
9.	Collimator	16	344	3.0
10.	Drift Space	16	360	-

Table II: Beam Specifications

1. Production angle: 2.0 mrad

Beam length: 360 ft. 2.

Diameter of beam at experiment site: .5 in. 3.

Solid angle subtended by beam: 10^{-8} sr. 4.

Neutron intensity: ~10⁹ per 10¹³ interacting protons 5.

Figure's: Beam Layout – Plan View

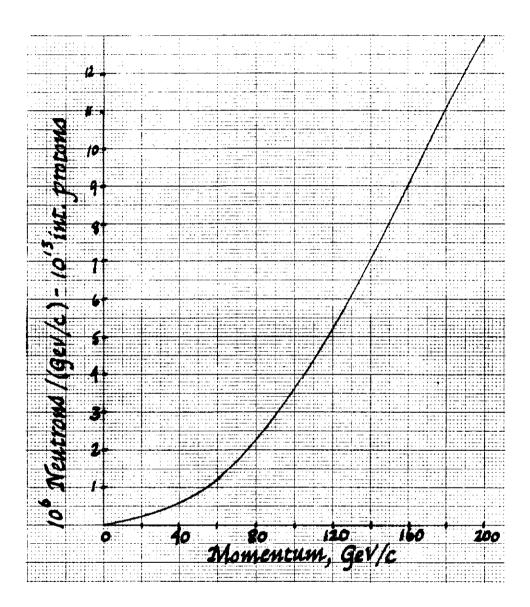


Figure 2: Neutron (proton) spectrum from Trilling formula. $\Delta\Omega=1.05\times10^{-8}$. Integrated flux $\approx10^9$ neutrons/10¹³ interacting protons.